



Titre: Editorial: Water Resource Recovery Modelling
Title:

Auteurs: Mathieu Spérandio, Yves Comeau, & Leiv Rieger
Authors:

Date: 2019

Type: Article de revue / Article

Référence: Spérandio, M., Comeau, Y., & Rieger, L. (2019). Editorial: Water Resource Recovery Modelling. Water Science and Technology, 79 (1).
Citation: <https://doi.org/10.2166/wst.2019.059>

Document en libre accès dans PolyPublie

URL de PolyPublie: <https://publications.polymtl.ca/9070/>
PolyPublie URL:

Version: Version finale avant publication / Accepted version
Révisé par les pairs / Refereed

Conditions d'utilisation: Tous droits réservés / All rights reserved
Terms of Use:

Document publié chez l'éditeur officiel

Titre de la revue: Water Science and Technology (vol. 79, no. 1)
Journal Title:

Maison d'édition: IWA Publishing
Publisher:

URL officiel: <https://doi.org/10.2166/wst.2019.059>
Official URL:

Mention légale: © 2019. This is the author's version of an article that appeared in Water Science and Technology (vol. 79, no. 1) . The final published version is available at
Legal notice: <https://doi.org/10.2166/wst.2019.059>

Water Science & Technology

Vol. 79.1, January 29, 2019

Guest Editors

Mathieu Spérandio, INSA de Toulouse, France

Yves Comeau, Polytechnique Montréal, Canada

Leiv Rieger, InCTRL Solutions Inc., Canada

Editorial

Water Resource Recovery Modelling

As our infrastructure is transitioning from wastewater treatment to resource recovery, so must our models evolve to address the needs this transition brings. Nutrient recovery, energy production or neutrality, biomass specialization for new conversion pathways, green-house gas mitigation and more stringent effluent limits for water reclamation are driving new model development efforts and increasingly sophisticated applications of modelling. These new needs enlarge the range of biological, physical and chemical mechanisms that we need to consider in our models. Exchanging and capitalizing on these knowledges are key challenges for modellers that will bring benefits to design, operation, teaching and research.

In this issue of *Water Science & Technology*, nine papers were selected that contribute to various aspects of the field of modelling water resource recovery facilities (WRRFs). Seven of these were presented or directly arose from the 5th Water Resource Recovery Modelling (WRRmod; previously known as the Wastewater Treatment Modelling, WWTmod) Seminar held in Lake Beauport, Canada in March 2018.

A review of outlook and challenges of WRRF modelling are first presented (Regmi et al., 2019). This collective paper was produced by a concerted effort of 24 individuals from various sectors of the wastewater industry.

Plant-wide aspects of modelling are then presented in two papers. Very low sludge retention time (SRT) and high rate activated sludge processes to minimize carbon oxidation and maximize organic carbon recovery by considering colloids and flocculation mechanisms are first presented (Hauduc et al., 2019a).

A general plantwide model in which the sulfur and iron cycles were added is then presented and tested (Hauduc et al., 2019b).

Biofilm modelling by a zero-dimensional biofilm model (0DBFM) was developed for moving bed bioreactors (MBBRs) (Plattes, 2019). Detachment of biofilm and attachment of suspended matter from the bulk liquid are considered in the model.

Inhibitory substances on biological nutrient removal systems motivated the development of a simulation framework using quaternary ammonium compounds (commonly used in industrial cleaners; Conidi et al., 2019). Biosorption and biodegradation by nitrifiers and heterotrophic organisms were simulated.

Two papers on process control are then presented. First, online control by prediction of ammonium and nitrate using a stochastic model is presented (Stenft et al., 2019). Resulting improved aeration control was shown to reduce electricity costs and improve resource recovery.

Ammonia-based aeration control coupled with SRT (ABAC-SRT) to control ammonia in the activated sludge process is then presented (Schraa et al., 2019). Energy consumption reduction over 30% can be expected compared to a traditional dissolved oxygen control method.

A compartmental model (CM) was shown to provide more realistic conditions than a conventional tank-in-series (TIS) configuration for the estimation of nitrous oxide production (Bellandi et al., 2019). The CM improved hydrodynamic consideration of local conditions and recirculation patterns both under steady state and dynamic conditions versus the TIS approach.

Thermal hydrolysis processes (THPs) can enhance biogas production in anaerobic digestion, reduce viscosity for improved mixing and dewatering, and reduce and sterilize cake solids. A combined energy (thermal heat and calorific) and process model was developed and applied at Blue Plains advanced WRRF (Aichinger et al., 2019). It was shown that dynamic effects were responsible for losses in electricity production of up to 29%.

References

- Aichinger, P., DeBarbadillo, C., Al-Omari, A. & Wett, B. 'Hot topic' – combined energy and process modeling in thermal hydrolysis systems. *Water Science & Technology* 79 (1), 84–92.
- Bellandi, G., De Mulder, C., Van Hoey, S., Rehman, U., Amerlinck, Y., Guo, L., Vanrolleghem, P. A., Weijers, S., Gori, R. & Nopens, I. Tanks in series versus compartmental model configuration: Considering hydrodynamics helps in parameter estimation for an N₂O model. *Water Science & Technology* 79 (1), 73–83.
- Conidi, D., Andalib, M., Andres, C., Bye, C., Umble, A. & Dold, P. L. Modeling quaternary ammonium compound inhibition of biological nutrient removal activated sludge. *Water Science & Technology* 79 (1), 41–50.
- Hauduc, H., Al-Omari, A., Wett, B., Jimenez, J., De Clippeleir, H., Rahman, A., Wadhawan, T. & Takacs, I. Colloids, flocculation and carbon capture - A comprehensive plantwide model. *Water Science & Technology* 79 (1), 15–25.
- Hauduc, H., Wadhawan, T., Johnson, B., Bott, C., Ward, M. & Takács, I. b Incorporating sulfur reactions and interactions with iron and phosphorus into a general plantwide model. *Water Science & Technology* 79 (1), 26–34.
- Plattes, M. Presentation and evaluation of the zero-dimensional biofilm model 0DBFM. *Water Science & Technology* 79 (1), 35–40.
- Regmi, P., Stewart, H., Amerlinck, Y., Arnell, M., Garcia, P. J., Johnson, B., Maere, T., Miletic, I., Miller, M., Rieger, L., Samstag, R., Santoro, D., Schraa, O., Snowling, S., Takacs, I., Torfs, E., van Loosdrecht, M. C. M., Vanrolleghem, P. A., Villez, K., Volcke, E. I. P., Weijers, S., Grau, P., Jimenez, J. & Rosso, D. The future of WRRF modelling – outlook and challenges. *Water Science & Technology* 79 (1), 3–14.
- Schraa, O., Rieger, O., Alex, J. & Miletic, I. Ammonia-based aeration control with optimal SRT control: improved performance and lower energy consumption. *Water Science & Technology* 79 (1), 63–72.

Stentoft, P. A., Munk-Nielsen, T., Vezzaro, L., Madsen, H., Mikkelsen, P. S. & Møller, J. K. Towards model predictive control: online predictions of ammonium and nitrate removal by using a stochastic ASM. *Water Science & Technology* 79 (1), 51–62.